1. (6 pts.) In Chapter 1 of his text, Sommerville points out that while the modern world can’t function without software, there are still many reports of “software failures” and criticisms of software engineering as being inadequate for modern software development. He goes on to share his view that many so-called software failures are a consequence of two factors. Describe these two factors and explain how they relate to these reports.

2. (6 pts.) In discussing whether or not software engineering has reached the status of a legitimate engineering discipline, we considered “SWEBOK”. What is SWEBOK and where did it come from? List 3 of the SWEBOK objectives discussed in class.
3. (10 pts.) Sommerville discusses the issue of “heterogeneity” in the context of key challenges facing software engineering (SE). Which of the following observations did Sommerville make in connection with this specific issue? Circle either “did” or “did not”, as appropriate, for each. To compensate for random guessing, your score in points will be 2 times the number of [correct minus incorrect] answers, or 0 – whichever is greater. Therefore, if you are not more than 50% sure of your answer, consider skipping the observation.

   a. Increasingly, systems are required to operate as distributed systems across networks that include different types of devices. did did not

   b. An important difference between generic and bespoke software products concerns who develops and controls the software specification. did did not

   c. In addition to the technical processes of software development, SE also includes different activities such as software project management and the development of tools, methods, and theories to support software production. did did not

   d. Software may have to execute on mobile phones as well as general-purpose computers. did did not

   e. New software must often be integrated with older legacy systems written in different programming languages. did did not

4. (3 pts.) Which one of the following would be Sommerville’s choice for the single “best” example of a hybrid software engineering development method or process in use today that brings together elements from all of the generic process models, illustrates good practice in specification and design, and supports prototyping? (Circle ONE only.)

   a. Spiral Development f. reuse-based development

   b. plan-driven development g. the Rational Unified Process (RUP)

   c. the New Rational Waterfall process h. Incremental Delivery

   d. incremental development i. Scrum

   e. agile development j. (none of the above)
5. (3 pts.) What, according to Sommerville, is the principal distinction between plan-driven and agile processes? (Circle ONE only.)

a. Agile processes explicitly incorporate risk assessment and resolution while plan-driven processes do not.

b. Plan-driven process activities are planned in advance while planning is incremental in agile processes.

c. Agile process activities incorporate incremental development while plan-driven process activities do not.

d. Agile process activities are iterative in nature while they are sequential in plan-driven processes.

6. (3 pts.) One of the issues of professional and ethical responsibility for software engineers discussed in class was that of "competence." Which ONE of the following, if any, describes the issue as discussed?

a. Licensed, professional software engineers are expected to demonstrate competency in all aspects of software development and for all application types.

b. To maintain independence and sound judgement concerning ethical issues that may arise in a project, software engineers should ideally have an ample competence and minimal obligations.

c. Software engineers should be aware of local laws governing the legal authority (i.e., competence) of courts or other bodies to deal with the intellectual property issues that may arise in software development.

d. Software engineers suspected of unethical behaviour must first be found competent to defend their actions before being required to take part in any formal disciplinary review process.

e. (none of the above)

7. (3 pts.) Which one of the following best describes a requirement’s **Fit Criterion**, as described in a Volere requirement shell? (Circle ONE only.)

a. A description of the reason for the requirement.

b. A measurement of the requirement making it possible to test if it is satisfied by a (system) solution.

c. A description of the extent to which procurers or end-users want or need the requirement to be implemented.

d. A description of political or organizational factors that may affect the requirement.

e. A description of the compatibility or “fit” of the requirement with other system requirements.
8. (4 pts.) Sommerville notes that a particularly difficult situation for professional engineers arises when their employer acts in an unethical way. One example he gives concerns a company that is responsible for developing a safety critical system and, because of time pressure, falsifies safety validation records. What does Sommerville advise that a software engineer employed by such a company do in this situation? (Circle ONE only.)

a. Since the example concerns a safety critical system with predefined validation criteria, Sommerville feels that the blatant falsification of records must always be reported to both development and customer management, and if necessary, made public.

b. Sommerville argues that since the predefined validation criteria being falsified may be unnecessarily strict, the software engineer should always defer to management judgment in such situations.

c. Sommerville notes that because the system may fail and cause an accident even when properly validated, it is not the responsibility of the software engineer to alert anyone of the situation.

d. Since the engineer is an employee of the development organization, his responsibility is to always maintain confidentiality and resolve the situation in such a way that does not embarrass his employer.

e. As suggested by Laudon (1995) and Johnson (2001), the engineer should consider the situation from a philosophical standpoint where the basic principles of ethics are considered, and then apply these principles to the particular situation at hand.

f. (None of the above.)

9. (16 pts.) Match each description/image below to the SINGLE MOST APPROPRIATE TERM among the following. (Note: terms may apply to none, one, or more than one description.)

A. Boehm’s Spiral Development  
B. Throw-away Prototyping  
C. Mills’ Incremental Delivery  
D. Reuse-based Development  
E. Volere  
F. RUP  
G. Incremental development  
H. IDE  
I. Waterfall  
J. COCOMO

___ An important innovation is explicitly incorporating the deployment of software in a user’s environment as part of the development process.

___ Now the standard approach for building many types of business systems.

___ A framework within which tools are combined to work together in support of software engineering process activities.

___ Increments are deployed for actual work-place use by end-users, permitting realistic evaluation of practical usefulness.

(_cont’d on next page)
In this model, phases are more closely related to business rather than technical concerns.

The need to ensure that software properly implements external regulations (such as the Sarbanes-Oxley accounting regulations) may involve bureaucratic procedures that result in process conflicts with this approach.

Usually leads to reduced cost and faster delivery of software, but requirements compromises may lead to a system that does not meet the real needs of users.

Although rarely used as published for practical software development, the model has been very influential in helping people think about iteration in software processes and in introducing the risk-driven approach to development.

A potential problem is that requirements may not be partitionable into usable, stand-alone increments.

A “practice perspective” describes six fundamental best software engineering practices that are recommended for use in systems development.

Model is mostly used to help coordinate the work associated with large systems engineering projects where a system is developed at several sites.

System structure tends to degrade over time, making software change increasingly difficult and costly unless time and money is spent on refactoring.

The inflexible partitioning of the project into distinct stages can make it difficult to respond to changing customer requirements.

Increments are made available for customer evaluation and feedback, but not necessarily for actual work in the customer’s own environment.
10. (14 pts.) Match each description/image below to the **SINGLE MOST APPROPRIATE TERM** among the following. (Note: terms may apply to none, one, or more than one description/image.)

<table>
<thead>
<tr>
<th>Description/Image</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. mockup</td>
<td>H. “Wizard of Oz” prototyping</td>
</tr>
<tr>
<td>B. breadboard</td>
<td>I. simulation</td>
</tr>
<tr>
<td>C. horizontal prototyping</td>
<td>J. compound documents</td>
</tr>
<tr>
<td>D. vertical prototyping</td>
<td>K. component and application assembly</td>
</tr>
<tr>
<td>E. throw-away prototyping</td>
<td>L. LISP, APL, SmallTalk</td>
</tr>
<tr>
<td>F. back-to-back testing</td>
<td>M. RAD environments</td>
</tr>
<tr>
<td>G. experimental prototyping</td>
<td>N. paper prototyping</td>
</tr>
</tbody>
</table>

___ “A non-functioning but realistic looking prototype was developed to test the market appeal of the new devise.”

___ Utilize high level languages integrated with a database; used to develop data-intensive business applications.

___ Generally focuses on “breadth” by incorporating relatively many features but with relatively low fidelity.

___ Potential problem is that developers may be pressured to deliver the result as the final system.

___ Objective is to evaluate a proposed solution for feasibility / performance.

___ Emphasis is on function with little or no attention to appearance.

___ “It was decided to develop a prototype that would very realistically reflect only that system functionality that handles emergency operator over-ride situations.”

___ Typeless, interpretive, high-level prototyping languages.

___ “To realistically evaluate the dynamic behavior of different interface designs for a new chess playing program before implementing its core (chess playing) engine, Company XYZ hired a chess master to simulate the engine in real-time from another city as test subjects played chess with prototypes reflecting the different designs.”

___ Emphasis is on fidelity as opposed to completeness.

___ Requires a *validated*, high-fidelity executable prototype.

___ First of what is often a two stage process aimed at evaluating interface designs.

___ Combines a product model with a model of the product’s environment to study their interactions.

___:
11. (12 pts.) Sommerville poses 10 questions concerning technical, human, and organizational matters that may be useful in determining the right balance between a plan-driven and an agile development approach. One of these, for example, is "How large is the system that is being developed?" Give 3 of the remaining 9 questions together with his specific recommendations based on the questions’ possible answers.

12. (10 pts.) Mountain Goat Software’s website suggests a number of "best practices" for conducting Daily Scrum Meetings. Circle either “true” or “false”, as appropriate, for each of the following statements concerning these meetings. To compensate for random guessing, your score in points will be 2 times the number of [correct minus incorrect] answers, or 0 – whichever is greater. Therefore, if you are not more than 50% sure of your answer, consider skipping the statement.

a. The old joke referenced on the site in which a chicken and a pig are talking was used to illustrate the key concept of collective ownership among team members. true false

b. To keep the discussion brisk but relevant, Scrum meetings are strictly time-limited to 15 minutes. true false

c. During the daily scrum, each team member answers the following three questions: (1) What did you do yesterday? (2) What will you do today? (3) Are there any impediments in your way? true false

d. Any impediments identified in the meeting must be resolved before the meetings ends. true false

e. Many teams enforce a rule by which only those who are committed are allowed to talk during the daily scrum meeting. true false
13. (19 pts.) Match each description/example below to the **SINGLE MOST APPROPRIATE TERM** among the following. (Note: terms may apply to none, one, or more than one description.)

A. system goal
B. user requirements
C. system constraint
D. system requirements
E. domain requirement
F. system attribute
G. external requirement
H. process constraint
I. operational specification
J. form/template-based specification
K. interface specification
L. scenario
M. Software Requirements Document (a.k.a. an “SRS”)

___ Example would be:
```c
interface PrintServer {
    // defines an abstract printer server
    // requires: interface Printer, interface PrintDoc
    // provides: initialize, print, displayPrintQueue, cancelPrintJob, switchPrinter
    void initialize ( Printer p ) ;
    void print ( Printer p, PrintDoc d ) ;
    void displayPrintQueue ( Printer p ) ;
    void cancelPrintJob (Printer p, PrintDoc d) ;
    void switchPrinter (Printer p1, Printer p2, PrintDoc d) ;
} //PrintServer
```

___ Detailed descriptions of system services and constraints that may serve as the basis for a contract.

___ Example would be: "The deceleration of the train shall be computed as:

\[ D_{\text{train}} = D_{\text{control}} + D_{\text{gradient}} \]

where \( D_{\text{gradient}} \) is \( 9.81 \text{m/s}^2 \cdot \text{compensated gradient/alpha} \) and where the values of \( 9.81 \text{m/s}^2/\text{alpha} \) are known for different types of trains”.

___ Example would be: "The system shall be fully compliant with all mandatory Family Educational Rights and Privacy Act (FERPA) standards for privacy."

___ Example would be: "Should integrate easily with customers’ other systems."

___ Example would be: “expected mean time to failure”

___ Example would be:
```
BIG := A[1]
i := 2
while i <= N do
    if A[i] > BIG then BIG := A[i] end_if
    i := i+1
end_while
```

___ Example would be: "At least two fully functioning rocket thrusters are required to reach escape velocity at 14.5038 psi."

___ Example would be: "system response time for this function under full operational load shall be < 2 seconds"

___ Usually suffers from not being verifiable.

___ Official statement of what is required of system developers; it should include both user and system requirements.

(cont’d on next page)
13. (cont’d)

___ Example would be: “The system should be easy to use by experienced controllers and should be organized in such a way that user errors are minimized.”

___ Example would be: "The development team is required to utilize the Extreme Programming (XP) development paradigm.”

___ Example would be:

**pre-condition:** N ≥ 1  
**post-condition:** there exists an i in [1,N] such that  
BIG=A[i] & for every j in [1,N], BIG ≥ A[j] & A is unchanged

___ Example would be: "The system is required to meet UK CENELEC standards EN 50126, EN 50128, and EN 5023 before being approved for deployment."

___ Example would be: "Use of the Eclipse IDE is mandatory."

___ Example would be:

| **Insulin Pump/Control Software/SRS/3.3.2** |
|----------|-----------------------------------------------|
| **Function** | Compute insulin dose: safe sugar level. |
| **Description** | Computes the dose of insulin to be delivered when the current measured sugar level is in the safe zone between 3 and 7 units. |
| **Inputs** | Current sugar reading (r2); the previous two readings (r0 and r1). |
| **Source** | Current sugar reading from sensor. Other readings from memory. |
| **Outputs** | CompDose—the dose in insulin to be delivered. |
| **Destination** | Main control loop. |

___ Statements in natural language plus diagrams of system services and constraints, written primarily for customers.

___ Example would be:

**t0**: The user enters values for input array A. The values are [1, 23, -4, 7, 19].

**t1**: The user executes program MAX.

**t2**: The value of variable BIG is 23 and the values of A are [1, 23, -4, 7, 19].

On my honor, I have neither given nor received unauthorized aid on this exam and I pledge not to divulge information regarding its contents to those who have not yet taken it.

_______________________
SIGNATURE